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ABSTRACT

The Bialer Scale and the Nowicki-Strickland Scale were administered twice, 4 weeks apart, to 526 students in the third through sixth grade from four public schools in a rural, predominately white, midwestern community. The association of verbal ability and the reliabilities of the locus of control scales were assessed in view of evidence that the relationship between locus of control and verbal ability may be an artifact of the reliability characteristics of the locus of control scale. Results indicated that the relationship between reliability and verbal ability may be both grade- and scale-specific. Reliability estimates both across and within grade levels for both scales were highly variable and frequently low in value. The implications for evaluation research and the possible operation of different developmental constructs that may account for differences in performance are discussed. (Author/PN)

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Children's Locus of Control Scales: A Reappraisal of Reliability Characteristics

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Abstract

The association of verbal ability and the reliabilities of two children's locus of control scales was assessed in view of evidence that the relationship between locus of control and verbal ability may be an artifact of the reliability characteristics of the locus of control scale. Results indicated that the relationship between reliability and verbal ability may be both grade- and scale-specific. The implications for evaluation research and the possible operation of different developmental constructs that may account for differences in performance are discussed.

Children's Locus of Control Scales: A Reappraisal of Reliability Characteristics

Although much of the early research designed to investigate the locus of control construct was concerned with the correlates of internal and external control orientations in adults, there has been an increasing effort to study locus of control expectancies in children and adolescents. This growth is indicated at least in part by the development of a number of scales designed to assess children's beliefs in locus of control. Gilmor (1978) reviewed nine scales that have been constructed specifically for use with children and/or adolescents and concluded that "the internal and re-test reliability characteristics of the various measures are generally adequate" (p. 7). However, the results of a study reported by Gorsuch, Henighan, and Barnard (1972) suggest that even such a modest conclusion may be premature.

Gorsuch et al. (1972) argued that a test may be reliable for one part of a sample and unreliable for another part of that sample. Bejar (1980) has recently described such a test as lacking psychometric invariance. To test their hypothesis, Gorsuch et al. (1972) administered the Bialer (1961) locus of control scale to a group of fourth- and fifth-grade children who were split into verbal ability groups. Internal consistency reliabilities (coefficient alpha) for the Bialer Scale were poor overall but were even worse for middle ability groups. Because the items from the locus of control and verbal measures had been intermixed, the Bialer Scale was readministered by itself after three months. This time the correlation of each group's verbal ability score with that group's locus of control reliability

estimate was .95. Reliabilities ranged from approximately .10 for the low ability group to approximately .60 for the high ability group. The test-retest reliabilities were also highly correlated with ability group (r = .86). In a second study employing Miller's revision of the Bialer Scale with a group of fifth-grade students, ability level correlated .79 with internal consistency estimates. Reliabilities again ranged from about .10 to .60 for the low and high ability groups, respectively.

Gorsuch et al. (1972) concluded that the most plausible interpretation of their results was that some groups of children had responded randomly (i.e., demonstrated low reliability) because they did not understand the locus of control items. If children with low verbal ability tended to respond randomly to the test items while high verbal ability children responded more reliably, the locus of control means for the two groups could be expected to differ systematically. It was pointed out that such a situation could cause locus of control scores to correlate with verbal ability as an artifact of reliability. Gorsuch et al. (1972) stated further that a spurious correlation between locus of control scores and verbal ability would also imply the possibility of spurious correlations between those scores and variables that correlate with verbal ability.

The implications of comparing groups on a test that has different psychometric properties in different populations were examined by Bejar (1980). He demonstrated that the effectiveness or, conversely, the apparent ineffectiveness of an experimental treatment may be incorrectly assessed as an artifact of this type of psychometric problem. The evaluation of programs designed to alter children's locus of control expectancies (e.g., see Searcy & Hawkins-Searcy, 1979) may be complicated by the possibility of

such psychometric variation. Gilmor (1978) cogently pointed out that the possibility of a verbal ability artifact is especially important in light of the fact that most of the validity claims for the locus of control measures are based in part on relationships with socioeconomic status, age, and achievement--all factors that could be expected to covary with verbal ability. He endorsed the recommendation of Gorsuch et al. (1972) that further examination of the reliability characteristics of other children's locus of control scales would be useful.

The present study was an attempt to reevaluate the reliability characteristics of two scales that have been used frequently in studies of children's locus of control beliefs--the Bialer Scale and the Nowicki-Strickland Scale (1973). Including the Bialer Scale provided an opporunity to replicate the findings of Gorsuch et al. (1972), and including the Nowicki-Strickland Scale allowed for an evaluation of what Gilmor (1978) said is probably the "most attractive choice for measurement of generalized locus of control" (p. 8). Special emphasis was placed on assessing the effects of verbal ability on the reliability estimates of the scales. Grade level was also evaluated in relation to its effect on reliabilities.

Method

Subjects

The subjects for this study were 526 third-, fourth-, fifth-, and sixth-grade children (247 boys and 279 girls) from four public schools serving predominantly white, rural midwestern communities. The number of children per grade level was as follows: third-grade, N=155; fourth-grade, N=142; fifth-grade, N=105; and, sixth-grade, N=124.

Instruments

Two locus of control scales were studied. The Bialer Scale consists of 23 yes-no questions designed to measure children's generalized expectancies about the locus of reinforcing events. Gozali and Bialer (1968) reported a seven day test-retest reliability of .84 for the scale; however, as noted above, the reliability estimates reported by Gorsuch et al. (1972) were not nearly as high. The Nowicki-Strickland Scale is also meant to be a generalized measure of internal-external beliefs, and the 40 questions are again answered in yes-no fashion. Split-half reliabilities of from .63 to .81 for third- through twelfth-grade children were reported; test-retest coefficients ranged from .63 to .71 for third- to tenth-grade groups (Nowicki & Strickland, 1973). Both scales were scored so that each internal response was given a "1;" therefore, high scores represented greater internality. This procedure reversed the standard scoring for the Nowicki-Strickland Scale but was implemented to facilitate comparisons between the two locus of control scales. The fact that both scales used a yes-no response strategy controlled for any possible format effects.

The Otis-Lennon Mental Ability Test (Otis & Lennon, 1967) was used as a measure of verbal ability. Three of the four schools participating in the study routinely administered the Otis-Lennon test at the third- and fifth-grade levels so that use of this instrument was well integrated with pre-existent testing programs. The Elementary I Level (Form J) was administered to the third-grade sample, and the Elementary II Level (Form J) was administered to the fourth-, fifth-, and sixth-grade samples.

Procedure

The Otis-Lennon test was administered to those subjects for whom school

records of current (viz., Spring 1980) scores were not available. Because of prior commitments to other testing programs, the fourth- and sixth-grade children at one school could not be tested; verbal ability data for that small group of children were treated as missing, excluding them from later analyses requiring that information. Approximately one week after the Otis-Lennon was completed, the Bialer Scale and the Nowicki-Strickland Scale were administered to all subjects. Order of presentation was counter-balanced between schools. The instructions to the subjects were a modified version of those used by Bialer (cited in Phares, 1976) and were presented with the scale items via an audiotape recording.

Subjects marked their responses on computer scorable answer sheets. The answer sheets had five response categories, but only the first two, corresponding to the true-false format of the locus of control scales, were to be marked by the subjects. Well over 99% of all responses could be easily coded as one of those two alternatives. In the small number of cases where one of the other alternatives had been marked, a "False" response was arbitrarily coded. The instances of response omission or double responding were coded as "External" responses. Four weeks after the initial administration of the locus of control scales, the subjects were again given the two scales.

Results

Analyses of both scales were conducted for the total sample, the four grade levels, and the verbal ability groups within each grade level, with the main emphasis being placed on the latter two categories. Preliminary analyses indicated no significant verbal ability differences between schools or sexes and no significant order of presentation effects for the

two locus of control scales. Based on these results the data were pooled across the above dimensions.

First administration total sample correlations across grade levels between the Otis-Lennon and the Bialer and Nowicki-Strickland scales were .31 ($p < .001$) and .32 ($p < .001$), respectively. Thus, internality as measured by both scales was significantly related to increased verbal ability. Although the relationship between the Nowicki-Strickland Scale and sex was statistically significant ($r = -.16$, $p < .001$), indicating a tendency for boys to score more internally than girls on that scale, the total variance accounted for by the sex variable was of no consequence. The intercorrelation of the two locus of control scales was .42, which was nearly identical to the intercorrelation ($r = .41$) reported by Nowicki and Strickland (1973). Internal consistency reliabilities as estimated by coefficient alpha for the total sample were .48 for the Bialer Scale and .58 for the Nowicki-Strickland Scale. Test-retest reliabilities were .38 and .43, respectively.

Coefficient alpha estimates for each grade level ranged from .32 (grade 4) to .57 (grade 6) for the Bialer Scale and from .49 (grade 3) to .67 (grade 6) for the Nowicki-Strickland Scale (see Table 1). The test-retest reliabilities ranged from .09 (grade 3) to .65 (grade 6) and from .19 (grade 3) to .75 (grade 6) for the two respective scales. These values were in the same range as those reported by Gorsuch et al. (1972) for their verbal ability groups. The correlation between coefficient alpha and grade level was .63 ($p > .05$) for the Bialer Scale and .91 ($p < .01$) for the Nowicki-Strickland Scale. The test-retest reliabilities were also highly correlated with grade level ($r = .90$, $p < .05$ for the Bialer Scale; $r = .85$, $p < .10$

for the Nowicki-Strickland Scale). The internal consistency reliabilities were compared across grade level by using Fisher r to Z transformed values (Hays, 1973, p. 664). No significant differences were found.

Insert Table 1 about here

One of the major purposes of the study was to investigate the relationship between children's verbal ability and their responses to the locus of control items. Subjects within each grade level were divided into five verbal ability groups on the basis of their Otis-Lennon performance; this meant that reliability estimates for the verbal ability groups were based on the responses of at least approximately twenty subjects. In Tables 2 and 3, respectively, the Bialer and Nowicki-Strickland scale internal consistencies for the ability groups by grade level are presented along with the correlations among the reliability estimates and ability groups and the results of analyses of variance computed with the actual locus of control scale scores. (These figures are based upon the first administration sample.)

Insert Tables 2 & 3 about here

The results of the one-way analyses of variance computed for the locus of control scores by ability groups are located in the last columns of Tables 2 and 3. At the third-grade level the tests for both the Bialer and the Nowicki-Strickland scales were not significant, indicating that mean performance on the locus of control scales at that grade level was not correlated with verbal ability. The differences among ability groups were

significant at all of the remaining grade levels (all p's < .05) except for the fifth-grade on the Bialer Scale ($F = 1.68$, $p < .20$).

Internal consistency reliabilities for the various ability groups are shown in the first five columns of Tables 2 and 3. Comparison of the reliabilities via the Fisher r to Z transformation showed that only the fifth-grade Nowicki-Strickland Scale sample demonstrated significant differences in reliabilities across ability groups ($\chi^2 = 9.56$, $p < .05$). The correlations between verbal ability groups and internal consistency estimates (see column six of Tables 2 and 3) were all positive except for the fourth-grade sample on the Bialer Scale ($r = -.46$). The remaining correlations ranged from .17 (grade 6, $p > .05$) to .89 (grade 5, $p < .05$) for the Bialer Scale and from .18 (grade 5, $p > .05$) to .81 (grade 3, $p < .05$) for the Nowicki-Strickland Scale. No systematic variation in the correlations was evident either within or between the locus of control scales. It was interesting that the correlation of coefficient alpha and verbal ability was largest for the fifth-grade sample on the Bialer Scale while that same sample provided the lowest correlation on the Nowicki-Strickland Scale.

Discussion

The results of the present study demonstrate that reliability estimates both across and within grade levels for the Bialer Scale and the Nowicki-Strickland Scale are highly variable and frequently low in value. Although locus of control scores for both scales were rather clearly related to verbal ability groups at all but the third-grade level, an examination of the results does not reveal any systematic or easily understandable relationships between the correlations obtained for verbal ability groups with internal consistency reliabilities when the two locus of control scales are

looked at either jointly or individually. Interestingly, the highest degree of association between verbal ability and reliability estimates for the Bialer Scale was found at the fifth-grade level. This is also the grade level at which Gorsuch et al. (1972) did their most extensive work. The present findings at that grade level for the Bialer Scale are consistent with those reported by Gorsuch et al. (1972), indicating increases in reliability with increases in verbal ability.

The present results suggest that conclusions drawn from the Gorsuch et al. (1972) study may be seriously restricted in their generalization to other grade levels. A reasonable implication of their findings is that the relationship they obtained between verbal ability and reliability for a combined sample of fourth- and fifth-grade children on the Bialer Scale and for a fifth-grade sample of Miller's revision of that scale would also be observed at other grade levels. The present study in essence was designed to test that hypothesis along with the related hypothesis that their results would generalize to another content-similar instrument (the Nowicki-Strickland Scale). The current data indicate that the fifth-grade level was the only grade level at which the association of verbal ability and reliability was significant for the Bialer Scale. The other grade levels demonstrated relationships that could not be said to differ from chance; therefore, it is possible that by some uncanny set of circumstances (luck-external control?) Gorsuch et al. (1972) may have selected a sample that confirmed their hypothesis but that was not representative of the findings that would have been obtained if other grade level samples had been employed.

In looking at the present Nowicki-Strickland Scale data, it is further suggested that the Gorsuch et al. (1972) findings may have been scale- as

well as grade-specific. On the Nowicki-Strickland Scale the fifth-graders demonstrated the lowest correlation between verbal ability and reliability for that scale, which was exactly the opposite of what was observed for the same sample on the Bialer Scale. Based on the present results, it appears that Gorsuch et al. (1972), had they been studying the Nowicki-Strickland Scale, would have needed to use a sample of third-graders in order to have obtained support for their hypothesis.

The present results thus seem to encourage caution in interpreting the results of the Gorsuch et al. (1972) study, suggesting that the findings reported in that study may have been both grade- and scale-specific. Though the present study indicated that reliability estimates were sometimes related to verbal ability, it seems that such relationships may not be generalizable across grades or instruments. What parameters determine the importance of the verbal ability distinction remain to be determined. In addition to the caution above based upon this report's primary emphasis on internal consistency estimates, the test-retest reliabilities obtained for both scales with the third-, fourth-, and fifth-grade samples suggest the need for closer scrutiny of this type of reliability for these scales.

Bejar (1980) has shown that it is necessary to take into account these psychometric considerations in conducting evaluation research. He suggested that a reanalysis of evaluation data from such a perspective should be considered as a routine procedure. The present data support this position given the wide range of reliability estimates obtained. Bejar (1980) pointed out, however, that reliance on specifying equal reliabilities for several groups may be of limited usefulness since reliability depends heavily on the variability of the groups scores. A test may be psycho-

metrically invariant across the groups, he argues, but differences in variability among the groups may lead to reliabilities that differ. Importantly, differences such as those observed in the present study may suggest that performance by the various groups may be accounted for by different constructs. In this case it is possible that different developmental constructs may be involved in children's performance on locus of control measures. It is clear that the further investigation of these issues with respect to children's locus of control and other areas of interest in developmental research would be useful, especially as a means of providing potentially more accurate descriptions of evaluation data and in identifying groups in which different constructs than those thought to be operating might be involved.

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Table 1. Internal Consistency (Coefficient Alpha) and Test-Retest Reliabilities by Grade Level for the Bialer Scale and the Nowicki-Strickland Scale.

	Grade Level	First Administration	Second Administration	Test-Retest
Bialer	3	.44	.32	.09
	4	.32	.47	.25
	5	.43	.40	.24
	6	.57	.52	.65
Nowicki-Strickland	3	.49	.52	.19
	4	.54	.62	.25
	5	.54	.71	.27
	6	.67	.76	.75

Table 2. Verbal Ability Group Internal Consistency Estimates, Correlations, and Analyses of Variance for Ability Group Locus of Control Scores - Bialer Scale

Grade	Internal Consistency Estimates by Verbal Ability Group (from low to high ability) 1	2	3	4	5	Correlations of verbal ability group and internal consistency	One-way analyses of variance on locus of control scores
3	.41	.38	.51	.44	.47	$\underline{r}$ = .56	F(4,146) = .31
4	.33	.30	.39	.45	.00	$\underline{r}$ = -.46	F(4,118) = 2.53*
5	.21	.20	.41	.60	.51	$\underline{r}$ = .89*	F(4,98) = 1.68
6	.44	.60	.53	.31	.66	$\underline{r}$ = .17	F(4,99) = 7.27**

*p < .05

**p < .01

Table 3. Verbal Ability Group Internal Consistency Estimates, Correlations, and Analyses of Variance for Ability Group Locus of Control Scores - Nowicki-Strickland Scale

Grade	Internal consistency estimates by verbal ability group (from low to high ability) 1	2	3	4	5	Correlations of verbal ability group and internal consistency	One-way analyses of variance on locus of control scores
3	.13	.33	.57	.34	.67	r = .81*	F(4,146) = 1.53
4	.42	.49	.56	.37	.57	r = .33	F(4,118) = 3.54**
5	.29	.48	.68	.06	.70	r = .18	F(4,98) = 2.81*
6	.44	.51	.67	.51	.64	r = .65	F(4,99) = 8.36**

*p < .05

**p < .01